

IN THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

AGERE SYSTEMS, INC, ET AL.,	:	CIVIL ACTION
Plaintiffs,	:	
	:	
v.	:	NO. 02-864
	:	
ATMEL CORPORATION,	:	
Defendant.	:	

MEMORANDUM OPINION

LEGROME D. DAVIS, J.

APRIL \_\_\_\_\_, 2004

Presently before this Court are the Motion for Summary Judgment of Non-Infringement of Claims 1 Through 5 of U.S. Patent No. 5,102,827 (“827 Mot.”) (Doc. No. 95), the Motion for Summary Judgment of Non-Infringement of Claims 1-3 and 5 of U.S. Patent No. 5,149,672 (“672 Mot.”)(Doc. No. 96), the Motion for Summary Judgment of Non-Infringement Pursuant to 35 U.S.C. § 271 (b) (“§ 271(b) Mot.”) (Doc. No. 97), the Motion for Summary Judgment Regarding U.S. Patent No. 34,269 (“269 Mot.”) (Doc. No. 98), the Motion for Summary Judgment of Non-Infringement of U.S. Patent No. 6,323,126 (“126 Mot.”)(Doc. No. 99; Doc. No.110), and the Motion for Summary Judgment of Non-Infringement of U.S. Patent No. 5,227,335 (“335 Mot.”) (Doc. No. 100), filed by Atmel Corporation (“Defendant”) on September 12, 2003.

**I. FACTUAL BACKGROUND AND PROCEDURAL HISTORY**

The facts of this case, and the detailed prosecution history of the patents involved are thoroughly canvassed in previous orders and will only briefly be recited here. The patents-in-suit assert claims in the field of fabricating and packaging semiconductor integrated circuits. A

“semiconductor integrated circuit” is a small chip made of a semiconductor material that contains a large number of microscopic components electrically interconnected so as to achieve a particular set of functions. The fabrication of a semiconductor integrated circuit generally begins with a semiconductor “substrate,” a thin disk or wafer of semiconductor material (often silicon) that is typically about eight inches in diameter and about one millimeter or less in thickness. Certain features of the microscopic components are fabricated either above or below the surface of the substrate. Multiple layers may then be fabricated on top of the substrate and these components. In order to prevent leakage of charge particles between levels, insulating layers of material, called a “dielectric,” are used. Portions of the dielectric are selectively removed through a series of steps in order to expose components below it and facilitate electrical connectivity to levels above the dielectric.

First, the entire surface of the dielectric is covered with a layer of a light-sensitive compound known as “photoresist.” Second, in the areas where the dielectric needs to be removed, the photoresist is selectively illuminated by passing light through a “mask” and projecting the mask image onto the surface of the photoresist, causing a chemical alteration in the exposed areas of the photoresist. A process then washes away the altered photoresist, thereby exposing the underlying dielectric in certain areas while leaving the unaltered photoresist in place shielding the underlying dielectric in other areas. The entire surface of the chip is then exposed to an “etchant” to chemically remove the dielectric from the exposed areas without significant effect on the remaining areas covered by photoresist. Finally, the wafer is cleaned and stripped of the remaining photoresist.

A subsequent sequence of operations then forms “contacts.” A conductive material, such

as a metal, fills each opening; another layer of metal is deposited over the entire surface of the chip, electrically connecting all of the contact terminals and all components. The multi-step process described above removes any undesired portions of the metal layer. As a result, openings, contacts, and interconnections within a single layer are formed. Because modern semiconductor integrated circuits often contain multiple layers, the basic sequence of steps for creating each additional layer repeats as needed. Finally, the wafer is separated into multiple, identical rectangular chips, each constituting an identical semiconductor integrated circuit, packaged, and used in various products. The Court conducted a Markman hearing on December 5, 2002 (Hrg. Tr., Doc. No. 48) and issued a Memorandum and Order construing many of the disputed terms on May 23, 2003 (“Mem. & Order”) (Doc. No. 63). Markman v. Westview Instruments, Inc., 52 F.3d 967, 976-79 (Fed. Cir. 1995)(en banc), cert. granted, 515 U.S. 1192 (1995).<sup>1</sup> After full factual and expert discovery, Defendant filed the motions for summary judgment now under consideration.

## II. STANDARD OF REVIEW

### A. Summary Judgment

Summary judgment is appropriate when “there is no genuine issue of material fact and . . . the moving party is entitled to a judgment as a matter of law.” Fed. R. Civ. P. 56(c); see also Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 247-48 (1986). In reviewing the record, “a court

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<sup>1</sup> The Court issued a Supplemental Order requesting additional briefing on the final limitation of Claim 1 of U.S. Patent No. 5,149,672. On June 23, 2003, Defendant filed an Additional Construction Brief (“D’s. Brief”)(Doc. No. 67) and on July 14, 2003, Plaintiff filed a Supplemental D’s. Brief. (“Pl’s. Brief”)(Doc. No. 75). Upon review of those briefs and accompanying documentation, the Court will construe the remaining disputed terms in this opinion.

must view the facts in the light most favorable to the nonmoving party and draw all inferences in that party's favor." Armbruster v. Unisys Corp., 32 F.3d 768, 777 (3d Cir. 1994). The moving party bears the burden of showing that the record discloses no genuine issues as to any material fact and that he or she is entitled to judgment as a matter of law. See Fed. R. Civ. P. 56(c); see also Adickes v. S.H. Kress & Co., 398 U.S. 144, 157 (1970). Once the moving party has met its burden, the non-moving party must go beyond the pleadings to set forth specific facts showing that there is a genuine issue for trial. See Fed. R. Civ. P. 56(e); see also Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 585-86 (1986). There is a genuine issue for trial "if the evidence is such that a reasonable jury could return a verdict for the nonmoving party." Anderson, 477 U.S. at 249. "Such affirmative evidence—regardless of whether it is direct or circumstantial—must amount to more than a scintilla, but may amount to less (in the evaluation of the court) than a preponderance." Williams v. Borough of W. Chester, 891 F.2d 458, 460-61 (3d Cir. 1989).

## **B. Summary Judgment of Non-Infringement**

A district court should approach a motion for summary judgment on the fact issue of infringement with great care. Palumbo v. Don-Joy Co., 762 F.2d 969, 974 (Fed. Cir.1985), overruled on other grounds by Markman, 52 F.3d at 976-79. Summary judgment may be decided as a matter of law when no genuine issue of material fact exists and no expert testimony is required to explain the nature of the patented invention or the accused product or to assist in their comparison. Amhil Enterprises Ltd. v. Wawa, Inc., 81 F.3d 1554, 1557-1558 (Fed. Cir. 1996) citing e.g., Sanitary Refrigerator Co. v. Winters, 280 U.S. 30, 36, 50 (1929); Singer Mfg. Co. v. Cramer, 192 U.S. 265, 275 (1904).

## 1. Literal Infringement

To prove infringement, the patentee must show that the accused device meets each claim limitation, either literally or under the doctrine of equivalents. Deering Precision Instruments, L.L.C. v. Vector Distribution Systems, Inc., 347 F.3d 1314, 1324 (Fed. Cir. 2003) citing Seal-Flex, Inc. v. Athletic Track & Court Constr., 172 F.3d 836, 842 (Fed.Cir.1999). See also Amhil Enters Ltd. Cole v. Kimberly-Clark Corp., 102 F.3d 524, 532 (Fed.Cir.1996). To establish infringement, the plaintiff must demonstrate that the accused processes contain each element of the asserted claim. S. Bravo Systems, Inc. v. Containment Tech. Corp., 96 F.3d 1372, 1376 (Fed. Cir. 1996). In order to prove vicarious liability for indirect infringement, a plaintiff who demonstrates direct infringement must also establish that the defendant possessed the requisite knowledge or intent to be held vicariously liable. Hewlett-Packard Co. v. Bausch & Lomb, 909 F.2d 1464, 1469 (Fed.Cir.1990); Moba v. Diamond Automation, 325 F.3d 1306, 1318 (Fed.Cir.2003); Dynacore Holdings Corp. v. U.S. Philips Corp., 2004 WL 627449, \*7 (Fed. Cir. 2004).

## 2. Doctrine of Equivalents

The doctrine of equivalents, a theory for finding patent infringement when the accused process or product falls outside the literal scope of the patent claims, evolved to prevent parties from evading liability for patent infringement by making trivial changes to avoid the literal language of the patent claims. Graver Tank & Mfg. Co. v. Linde Air. Prods. Co., 339 U.S. 605 (1950). Only when actual literal infringement is *not* present, is analysis under the doctrine of equivalents triggered. Hughes Aircraft Co. v. United States, 717 F.2d 1351, 1361 (Fed. Cir. 1983)(emphasis added). In making this determination, the court employs a three-part test which

considers whether the accused device performs substantially the same function, in substantially the same way, with the same result. Graver Tank, 339 U.S. at 608. Recently, the Supreme Court synthesized the analysis, asking whether the accused product or process contain elements identical or equivalent to each claimed element of the patented invention. Warner-Jenkinson Co., Inc. v. Hilton Davis Chem. Co., 520 U.S. 17, 40 (1997). In so doing, the Court noted that “[a]n analysis of the role played by each element in the context of the specific patent claim will thus inform the inquiry as to whether a substitute element matches the function, way, and result of the claimed element, or whether the substitute element plays a role substantially different from the claimed element.” Id.

**a. Prosecution History Estoppel**

If, during the application process, where the original application embraced the purported equivalent but the patentee narrowed his claims to obtain the patent or to protect its validity, the patentee surrendered certain claims or interpretations of the invention. Warner-Jenkinson Co. v. Hilton Davis Chemical Co., 520 U.S. 17 (1997). As a result, prosecution history estoppel prevents the patentee from invoking the doctrine of equivalents. Id.; See Festo Corp. v. Shoketsu Kinzoku Yogyo Kabushiki, 535 U.S. 722, 728 (2002)(“Festo VIII”)(“When a patentee responds to rejection of his application by narrowing his claims, the prosecution history estops him from later arguing that the subject matter covered by the original, broader claim was nothing more than an equivalent.”). Competitors may rely on the prosecution history of a patent, the public record of the patent proceeding, and amendment to the application that narrow the claims. Festo, 535 U.S. 722 (2002) citing Warner-Jenkinson, 520 U.S. at 29. Though most often made for a “substantial reason related to patentability,” even where the amendment’s purpose bears no

relation to patentability, the court might consider whether it might nonetheless require application of the estoppel doctrine. *Id.* at 736 *citing Warner-Jenkinson*, 520 U.S. at 40-41. As recently summarized in *Festo Corp. v. Shoketsu Kinzoku Yogyo Kabushiki*, 344 F.3d 1359 (Fed. Cir. 2003)(“*Festo IX*”), the *Warner-Jenkinson* presumption, treats a narrowing amendment as having been made for a “substantial reason related to patentability,” but a patentee's failure to overcome the *Warner-Jenkinson* presumption gives rise to the a presumption of surrender. *Id.* *citing Festo VIII*, 535 U.S. at 740 (“[W]hen the court is unable to determine the purpose underlying a narrowing amendment—and hence a rationale for limiting the estoppel to the surrender of particular equivalents—the court should presume that the patentee surrendered all subject matter between the broader and the narrower language.”).

The Court should first inquire whether an amendment filed in the Patent and Trademark Office (“PTO”) has narrowed the literal scope of a claim. *Pioneer Magnetics, Inc. v. Micro Linear Corp.*, 330 F.3d 1352, 1356 (Fed. Cir. 2003). If so, the court should determine whether the reason for that amendment was a substantial one relating to patentability. Without an articulated reason within the prosecution history, *Warner Jenkonson* presumes a substantial reason relating to patentability; in order to prevent application of prosecution history estoppel, the patentee must show, only through the evidence in the prosecution history record, that the reason for the amendment was not one relating to patentability. *Warner-Jenkinson*, 520 U.S. at 33; *Festo VI*, 234 F.3d at 586 & n. 6; *see also Pioneer Magnetics*, 330 F.3d at 1356 (stating that only the prosecution history record may be considered in determining whether a patentee has overcome the *Warner-Jenkinson* presumption, so as not to undermine the public notice function served by that record). If, based on either the patentee’s failure to overcome the presumption or

on the prosecution history record, the court concludes that the narrowing amendment pertained to a substantial reason relating to patentability, the patentee has surrendered all territory between the original claim limitation and the amended claim limitation. Festo IX, 344 F. 3d at 1366-67. See Festo VIII, 535 U.S. at 740 (“[W]hen the court is unable to determine the purpose underlying a narrowing amendment—and hence a rationale for limiting the estoppel to the surrender of particular equivalents—the court should presume that the patentee surrendered all subject matter between the broader and the narrower language.”). “Amendments may be of different types and may serve different functions. Depending on the nature and purpose of an amendment it may have a limiting effect within a spectrum ranging from great to small to zero.” Id. citing Hughes Aircraft Co. v. United States, 717 F.2d 1351, 1363 (Fed.Cir.1983). Whenever prosecution history estoppel is invoked as a limitation to infringement under the doctrine of equivalents, “a close examination must be made as to, not only what was surrendered, but also the reason for such a surrender.” Insta-Foam Products, Inc. v. Universal Foam Systems, Inc., 906 F.2d 698, 703-703 (Fed. Cir. 1990) citing Bayer Aktiengesellschaft v. Duphar Int'l Research, 738 F.2d 1237, 1243 (Fed. Cir.1984). However, the presumption of surrender can be overcome by analyzing the prosecution history to determine (1) whether the alleged equivalent was foreseeable; (2) whether the reason for the amendment or cancellation bore no more than a tangential relation to the equivalent in question; and (3) whether there is any other reason suggesting that the patentee could not reasonably be expected to have described “the insubstantial substitute in question.” Mycogen Plant Science, Inc. v. Monsanto Co., 2004 WL 363344, \*3 (Fed. Cir. 2004).



### **III. ANALYSIS**

#### **A. Non-Infringement of Claims 1 Through 5 of U.S. Patent No. 5,102,827**

As the Court has previously explained, the '827 patent discloses methods for forming electrical contact structures in semiconductor integrated devices, addressing two potential problems during the fabrication of such devices. A layer of silicide is often formed on the surface of a semiconductor substrate in order to minimize contact resistance and to improve the electrical connection between the underlying junction and the metal that is formed in an opening in the dielectric layer above the substrate surface. By depositing a silicide-forming material into an opening after it is etched into the dielectric layer and heating the wafer in a non-oxidizing atmosphere, the '827 patent seeks to resolve the potential loss of silicide material possible when an opening is etched into a dielectric layer to expose a contact region. As a result, a reaction occurs between the silicide-forming material and the semiconductor substrate and additional silicide material forms to replenish any silicide consumed by the etching process. In addition, the problem of misalignment of the openings etched into the dielectric layer such that only a portion of the contact region is exposed is remedied by the '827 patent method in which dopants, such as phosphorous ions, are implanted into the contact region to correct for any such misalignment by extending the contact region in a lateral direction remedies. Claims 1-5 and 9-12 of the '827 patent are at issue in this lawsuit.

#### **1. Arsenic Processes**

Defendant moves for summary judgment that it does not infringe Claims 1 through 5 of the '827 patent either literally or under the doctrine of equivalents because a phosphorous limitation was added during the prosecution to secure patentability, the '827 patent discloses but

does not claim implantation of arsenic, and the patentees narrowly claimed phosphorous only thereby excluding arsenic under the doctrine of equivalents. ‘827 Mot. at 6. The ‘827 patent, Claims 1-5 set forth the following:

1. In the manufacture of semiconductor integrated-circuit devices, a method for making electrical contact to at least one contact region on a semiconductor body, said method comprising the steps of depositing a dielectric layer on said body, etching an opening into said dielectric layer, said opening exposing an area which comprises at least a portion of said contact region, said contact region comprising a silicide formed before said etching step, implanting *phosphorous* after depositing said dielectric layer and etching said opening, depositing silicide-forming material after etching and implanting, heating in a non-oxidizing atmosphere, and depositing a metal layer.
2. The method of claim 1 in which said contact region comprises titanium silicide
3. The method of claim 1 in which said silicide-forming material comprises titanium.
4. The method of claim 1 in which said atmosphere comprises a constituent which promotes formation of a conductive compound with said silicide-forming material.
5. The method of claim 4 in which said silicide-forming material comprises titanium, and in which said atmosphere comprises nitrogen.

‘827 Patent at col. 4:45 through col. 6:19 (emphasis added). Because arsenic is plainly not phosphorous as required by the limitation, Defendant submits that the accused arsenic processes cannot literally infringe Claims 1-5 of the ‘827 patent. ‘827 Mot. at 7; Thomas Reb. Report at ¶ 79 (noting that Plaintiff concedes that because the accused processes with implanted arsenic lack implanted phosphorous, a required claim element, they cannot literally infringe Claims 1-5 of the ‘827 patent. Pl.’s Expert Infring. Rep. at 27. Instead, Plaintiff relies on the doctrine of equivalents to establish infringement.<sup>2</sup> Therefore, the Court turns its inquiry to alleged

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<sup>2</sup> See Reif Expert Rep. at 27 (“To the extend that the [Defendant’s accused process] does not infringe Claims 1-5 of the Chen ‘827 patent literally because arsenic is implanted rather than phosphorous, those claims are still infringed under the doctrine of equivalents. From the

infringement under the doctrine of equivalents.

Defendant argues that because the phosphorous claim limitation was added during prosecution, an inference that it was added to secure patentability arises that Plaintiff cannot rebut. ‘827 Mot. at 7. To support this, Defendant points to the patent itself where both arsenic and phosphorous are identified as n-type dopants, with arsenic as the preferred dopant “on account of its high diffusivity in silicide.” ‘827 Patent at col. 3:65-68. This recognition, Defendant suggests, establishes that arsenic was a foreseeable equivalent at the time of the amendment. See Mycogen, 2004 WL 363344, \*3 (noting that presumption of surrender can be overcome if prosecution history reveals whether the alleged equivalent was foreseeable, the reason for the amendment bore only a tangential relation to the equivalent, and whether any other reason exists explaining the patentees reasonable exclusion of a description of the equivalent).

Furthermore, Defendant argues, because the patentee discloses arsenic without claiming it, the doctrine of equivalents cannot apply under Johnson & Johnson Assoc., Inc. v. R.E. Service Co., Inc., 285 F. 3d 1046, 1055 (Fed. Cir. 2002). When a patent drafter discloses but declines to claim subject matter, that unclaimed subject matter is dedicated to the public. Application of the doctrine of equivalents to recapture subject matter deliberately left unclaimed would “conflict with the primacy of the claims in defining the scope of the patentee's exclusive right.” Johnson & Johnston, 285 F.3d at 1054 citing Sage Prods. Inc. v. Devon Indus., Inc., 126 F.3d 1420, 1424 (Fed.Cir.1997); see also Conopco, Inc. v. May Dep't Stores Co., 46 F.3d 1556, 1562 (Fed.

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standpoint of the claimed process, the differences between phosphorous and arsenic are insubstantial. As dopants, phosphorous and arsenic perform substantially the same function (altering the electrical conductivity of the silicon), in substantially the same way (providing electrons to serve as carriers). In addition, implantation of phosphorous and arsenic through contact holes achieves substantially the same result: correction of window misalignment.”)

Cir.1994) (“The doctrine of equivalents cannot be used to erase ‘meaningful structural and functional limitations of the claim on which the public is entitled to rely in avoiding infringement.’”); Charles Greiner & Co. v. Mari-Med Mfg., Inc., 962 F.2d 1031, 1036 (Fed. Cir.1992) (“Most important, however, a court must, in applying the doctrine, avoid significant conflict with the fundamental principle that claims define the limits of patent protection.”). Finally, Defendant argues that the patentee’s choice to claim narrowly while disclosing a range of dopants in the specification precludes a finding of infringement under the doctrine of equivalents. ‘827 Mot. at 11 citing Tanabe Seiyaku Co., Ltd. v. International Trade Commission, 109 F. 3d 726 (Fed. Cir. 1997); Moore U.S.A., Inc. v. Standard Register Co., 229 F. 3d 1091 (Fed. Cir. 2000).<sup>3</sup>

In response, Plaintiff first submits that prosecution history estoppel is inapplicable because the phosphorous limitation was not required to secure patentability. Pl’s. Resp. at 9. As outlined above, the Court may still require application of the estoppel doctrine, provided that either Plaintiff fails to overcome the presumptions or an independent review of the prosecution history record suggests that the narrowing amendment pertains to patentability. In such instances, the patentee has surrendered all territory between the original claim limitation and the amended claim limitation. Festo IX, 344 F. 3d at 1366-67. See Festo VIII, 535 U.S. at 740 (“[W]hen the court is unable to determine the purpose underlying a narrowing amendment—and

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<sup>3</sup> Defendant also cites to the language in the ‘827 patent where the specification notes that “among materials other than titanium, suitable as a silicide-forming material, are cobalt, platinum, and alloys of titanium, cobalt, and platinum. Other than nitrogen, suitable as an inert atmospheric constituent during annealing, argon or helium may be used, as well as mixtures of other gases.” ‘827 Patent at 3: 35-40. But, where the specification discusses the dopants, it points to arsenic and phosphorous only for n-channel devices and to boron for p-channel devices. Id. at 3:47-51.

hence a rationale for limiting the estoppel to the surrender of particular equivalents—the court should presume that the patentee surrendered all subject matter between the broader and the narrower language.”). To prove that the phosphorous implant limitation was not required to secure patentability, Plaintiff argues that the claim intended to clarify rather than secure allowance of the claim. Pl’s. Resp. at 9 citing Lee Decl. Ex. 7, Reif Opp. Decl. at ¶ 17. Plaintiff then recounts the amendment process, providing a detailed comparison between the language in Claim 1 and Claim 9 to conclude that because Claim 9 was allowed without the limitation, it could not have been a necessary limitation for Claim 1. Id. at 10-12; but see Lemelson v. TRW, Inc., 760 F.2d 1254 (Fed. Cir. 1985) (noting that the scope of each individual claim must be examined on its own merits, apart from that of other claims, even in the same patent). The Court is not persuaded by this argument.

Plaintiff next turns to Defendant’s argument that the doctrine of equivalents cannot apply because the ‘827 patent discloses without claiming arsenic. Plaintiff suggests that the Johnson & Johnson analysis is triggered only when the patentee explicitly discloses alternatives to the claimed embodiment without claiming them. Id. at 13 citing Maxwell v. J. Baker, Inc. v. United States International Trade Commission, 86 F.3d 1098 (Fed. Cir. 1996) cert. denied, 520 U.S. 1115 (1997). But, “as between the patentee who had a clear opportunity to negotiate broader claims but did not do so, and the public at large, it is the patentee who must bear the cost of its failure to seek protection for this foreseeable alteration of its claimed structure.” Sage Products, Inc. v. Devon Industries, Inc., 126 F.3d 1420, 1425 (Fed. Cir. 1997) citing Maxwell, 86 F.3d at 1108 (discussing danger of allowing patentee to file and prosecute narrow claims and then, during the course of litigation, expand its exclusive rights under the doctrine of equivalents,

thereby avoiding examination of the broad subject matter); see also International Visual Corp. v. Crown Metal Mfg. Co., 991 F.2d 768, 775 (Fed. Cir.1993) (doctrine of equivalents should not extend to disclosed, but unexamined, subject matter). The “disclosure-dedication” rule requires more than any generic reference to all members of a particular genus, but rather demands a disclosure “of such specificity that one of ordinary skill in the art could identify the subject matter that had been disclosed and not claimed.” PSC Computer Products, Inc. v. Foxconn Intern., Inc., 355 F.3d 1353, 1360 (Fed. Cir. 2004). In such an instance, the alternative matter disclosed has been dedicated to the public. Id. In this case, the disclosure makes reference to only two dopants for n-channel devices: “arsenic and/or phosphorous.” ‘827 Patent at 3:49. Yet, the claim language specifically employs only phosphorous. Id. at Claim 1, 4:55 (“implanting *phosphorous* after depositing said dielectric layer and etching said opening”)(emphasis added). This is a distinction sufficient to warrant promissory estoppel doctrine application under Johnson & Johnson and to grant summary judgment.

**B. Non-Infringement of Claims 1-3 and 5 of U.S. Patent No. 5,149,672**

The ‘672 patent involves the formation of electrical interconnections using tungsten in a semiconductor device. However, the ‘672 patent addresses a particular problem encountered during tungsten deposition that is distinct from the adhesion problem addressed in the ‘335 patent. Tungsten forms electrical contacts with “device junctions;” such junctions are either “N-type” or “P-type” and, ordinarily, the junction type will be opposite to the type of substrate in which the junction sits (*i.e.*, N-type junctions will sit in P-type substrates, and P-type junctions will sit in N-type substrates). When forming tungsten contacts to such junctions is that, when the junction depth is shallow, certain chemicals introduced during tungsten deposition such as

tungsten hexafluoride (WF<sub>6</sub>) may react with, penetrate, and consume the junction material. The more shallow a device junction, the more easily these undesirable reactions can have such an effect.

The use of “barrier layers” prevents the undesired reactions but traditional barrier layers often fail to prevent such interactions entirely. The ‘672 patent asserts a method of depositing tungsten under controlled conditions whereby any undesirable reaction of tungsten precursors with the junction material is “self-limiting” so that any undesirable reaction ceases before the thickness of the reaction product reaches the full junction depth. This method, when combined with a barrier layer, two measures of protection against damage to the junction material thereby enable the formation of reliable tungsten contacts in connection with shallow junctions.

On May 23, 2003, the Court issued a Memorandum and Order construing the majority of the disputed terms. The Court also issued a Supplemental Order requesting additional briefing on the final limitation of Claim 1 of U.S. Patent No. 5,149,672, specifically (1) whether the term “yield” is inadequately defined in the patent, thereby rendering claim 1 indefinite, and (2) whether this claim language includes a “step-plus-function” limitation, and therefore falls within § 112, ¶ 6, and if the claim does include such a limitation, how that limitation should be construed. Mem. & Order at 66-67. In the Memorandum and Order, the Court outlined in great detail the standard for claim construction on which it now relies. Mem. & Order at 2-8. But, in brief, claim construction is a question of law. Kopykake Enterprises, Inc. v. Lucks Co., 264 F.3d 1377, 1381 (Fed. Cir. 2001) citing Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1456 (Fed. Cir.1998) (en banc). In construing patent claims, we first look to the intrinsic evidence of record—the claims, the specification, and, if in evidence, the prosecution history. Vitronics Corp.

v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir.1996). If ambiguity remains after consideration of the intrinsic evidence, “extrinsic evidence may also be considered, if needed to assist in determining the meaning or scope of technical terms in the claims.” Pall Corp. v. Micron Separations, Inc., 66 F.3d 1211, 1216 (Fed. Cir. 1995) (citations omitted); see Bell Atlantic Network Services, Inc. v. Covad Comm. Group, Inc., 262 F.3d 1258, 1267 (Fed. Cir. 2001). Specifically, the claim language at issue reads “wherein said deposition temperature is chosen such that the yield of said junctions decrease not more than 10% compared to the yield obtained for the same function having a via aspect ration of .75 and having a contact of only aluminum.” ‘672 Patent col. 7:3-7.

#### 1. “yield”

Defendant argues that the determination of “yield,” even when read in light of the specification and prosecution history, does not permit a person of ordinary skill in the art to determine its meaning. D’s. Brief. at 2. Defendant suggests that the “word ‘yield’ in the semiconductor field customarily refers to the ‘percentage of finished products leaving a process compared to those entering the process.’” Id. at 3; Hurwitz Delc., Ex. 3. In other words, though the parties agree that “yield” refers to some criterion of successful or acceptable junction performance, the criterion itself is undeterminable from the patent language. Id. The specification language that includes the term “yield” is equally unhelpful, claims Defendant, articulating only that a relationship between temperature, self-limiting thickness, and yield exists without identifying how to determine said yield. Id. citing ‘672 Patent at col. 4:28-37, 49-59. Defendant suggests that the other specifications provide no guidance as they recite certain parameters related to junction performance that “cannot be combined into a pass/fail criterion”



from which an understanding of “yield,” can be gleaned. Id. at 5-7. Finally, Defendant disputes Plaintiff’s suggestion that the definition of “yield” would vary according to manufacturer acceptance requirements, arguing that a flexible definition is unworkable in the semiconductor production industry. Id. at 9.

Plaintiff suggests that, consistent with general usage of the term in the semiconductor industry, a person skilled in the art would easily conclude that the claim term “yield” as applied to junctions, describes “the percentage of device junctions that retain satisfactory electrical properties following contact formation, typically characterized by a contact resistance less than 10 ohms and a junction leakage current less than  $10^{-7}$  amps/cm<sup>2</sup>.” Pl’s. Brief at 5; ‘627 Patent col. 1:16-21. According to Plaintiff, the Defendant’s definition of “yield” more properly corresponds to a “product yield;” the treatise on which Defendant relies explains numerous “yields” all of which share one commonality in that they measure a portion of operational units as a fraction or percentage of the total units. Id. at n.1. Because the specification identifies two specific metrics, the term ‘yield’ is clearly defined. Id. at 6 citing E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co., 849 F. 2d 1430, 1433 (Fed. Cir. 1988)(“[I]t is entirely proper to use the specification to interpret what the patentee meant by word or phrase in the claim.”). When viewed in context of the specifications, the term “yield” does establish some criterion by which a manufacturer can measure junction performance. Defendant’s critique is valid, though the conclusion that “yield” is indefinite for lack of guidance is unsupported. However, Plaintiff’s definition, which depends largely on the specification, goes too far. Therefore, the Court construes “yield” as “the percentage of device junctions that retain satisfactory electrical properties following contact formation.” But, this does not end the inquiry.

## 2. claim language includes a “step-plus-function” limitation

In addition, Defendant suggests that the claim is subject to 35 U.S.C. § 112, ¶ 6 as a “step-plus-function limitation.” Section 112, ¶ 6 provides that:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

35 U.S.C. § 112, ¶ 6. According to § 12, ¶ 6, the word “combination” includes a combination of mechanical elements in an apparatus claim, a combination of substances in a composition claim, or a combination of steps in a method or process claim. O.I. Corp. v. Tekmar Col, Inc., 115 F. 3d 1576, 1582-83 (Fed. Cir. 1997). As in the instant example, for a combination method or process claim, a patentee may claim a specified function without reciting in the claim itself the acts necessary for performing that function. Id. at 1583. Such a claim limitation is a “step-plus-function” limitation and is limited to the means or steps specified in the written description and equivalents thereof. Apex Inc. v. Raritan Computer, Inc., 325 F. 3d 1364, 1371 (Fed. Cir. 2003); O.I. Corp., 115 F. 3d at 1583. As an initial question, however, the Court must determine whether the claim limitation is, in fact, a “step-plus-function claim limitation” subject to analysis under § 112, ¶ 6. Seal-Flex, Inc. v. Athletic Track and Court Const., 172 F. 3d 836, 849-50 (Fed. Cir. 1999). Where, as in this instance, the words “step for” do not appear in the claim, a presumption arises that § 12, ¶ 6 has not been invoked; that presumption may be rebutted only if the Court determines that the claim limitation does not recite sufficiently definite structure to perform the claimed function. Id.

Claim interpretation focuses on what the claim limitation accomplishes, i.e., it’s underlying function, in relation to what is accomplished by the other limitations and the

claim as a whole. If a claim element recites only an underlying function without acts for performing it, then § 112, ¶ 6 applies even without express step-plus-function language.

Id. at 850. Defendant argues that because the physical structures and processing conditions of the tungsten and aluminum junctions are unclear, the method of performing the function to determine “yield” is indefinite. Furthermore, the specification provides no corresponding acts that would clarify the ambiguity. Id. at 13-15. Plaintiff counters that the specification contains adequate corresponding acts to provide a person skilled in the art with the requisite information to understand how the tungsten deposition temperature may be selected for the desired yield. Pl’s. Brief at 9 citing Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F. 2d 1367, 1384 (Fed. Cir. 1986)(“a patent need not teach, and preferably omits, what is well known in the art”).

Specifically, the specification reads:

The temperature should preferably be chosen such that the device yield of working test junctions decreases no more than 10% compared to the yield obtained for the same junction having a via aspect ration of 0.75 and with a contact of only aluminum. (A test junction is an identical structure to the junction being contacted in the device but with no surrounding device structures and with suitable leads or contact pads for making electrical measurements.)

‘672 Patent col. 4:32-41. Though the claim language does not include express step-plus-function language, it nevertheless falls within § 112, ¶ 6 because it recites a step for performing a specified function without reciting the acts necessary to perform this step and achieve this function.

Because the Court has established that a step-plus-function limitation is at issue, the Court must now construe the limitation “to cover the corresponding . . . acts described in the specification.” 35 U.S.C. § 112, ¶ 6; Chiuminatta Concrete Concepts, Inc. v. Cardinal Industries, Inc., 145 F.3d 1303, 1308 (Fed. Cir. 1998). The Court turns to the written description of the

patent to find the acts that correspond to the step requiring selection of a deposition temperature “such that the yield of said junctions decrease not more than 10% compared to the yield obtained for the same function having a via aspect ration of .75 and having a contact of only aluminum.” B. Braun Medical, Inc. v. Abbott Laboratories, 124 F.3d 1419, 1424 (Fed. Cir. 1997). Only upon review of the specification of the ‘672 patent can one glean some determination of “deposition temperature” to achieve the desired yield. See ‘672 Patent at col. 4:32-41. ‘672 Patent at col. 4:32-41. In sum, the Court construes “yield” as “the percentage of device junctions that retain satisfactory electrical properties following contact formation.” The Court concludes that the claim language in question recites a step-plus-function limitation, and that this limitation should be construed in accordance with the specification language quoted above. See ‘672 Patent at col. 4:32-41.

Defendant contends that the Court’s interpretation of the final clause of Claim 1 as a “step-plus-function” limitation is consistent with its construction of the claim language “wherein said temperature and environment is controlled such that said interaction is self-limiting with a self-limiting thickness less than said junction depth.” D’s. Brief. at 9-10; Pl’s. Brief. at n.2. In contrast, Plaintiff asks the Court to reconsider construction of the above phrase and concedes that without such reconsideration, the record cannot support a finding that Defendant infringed the asserted claims of the ‘672 patent. Pl.’s Resp. to ‘672 Mot. at 6. Consistent with this interpretation and with the Court’s construction of all the ‘672 patent claim terms, Plaintiff’s request for reconsideration is denied and the Defendant’s motion for summary judgment is granted.

**C. Non-Infringement Pursuant to 35 U.S.C. § 271(b)**

Defendant moves for summary judgment that it does not induce infringement of the asserted claims of U.S. Patent Numbers 5,102,827, 5,149,672, 34,269, and 6,323,126 pursuant to 35 U.S.C. § 271(b). Section 271(b) provides that “[w]hoever actively induces infringement of a patent shall be liable as an infringer.” 35 U.S.C. § 271(b). In order to succeed on a claim of inducement of patent infringement, the patentee must show first that there has been direct infringement and second that the alleged infringer knowingly induced infringement and possessed specific intent to encourage another's infringement. Minnesota Min. & Mfg. Co. v. Chemque, Inc., 303 F.3d 1294 (Fed. Cir. 2002); see also Joy Technologies, Inc. v. Flakt, Inc., 6 F.3d 770 (Fed. Cir. 1993) (liability for either active inducement of infringement or for contributory infringement is dependent upon existence of direct infringement). To establish inducement, Plaintiff must show that (1) the defendant knowingly induced infringement, (2) that the defendant possessed specific intent to encourage another's infringement, not merely that the defendant had knowledge of the acts alleged to constitute inducement, (3) that the alleged infringer's actions induced infringing acts and, (4) that he knew or should have known his actions would induce actual infringements. Manville Sales Corp. v. Paramount Systems, Inc., 917 F.2d 544, 553 (Fed. Cir. 1990) citing Water Technologies Corp. v. Calco, Ltd., 850 F.2d 660, 668 (Fed. Cir. 1988); see also Hewlett-Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1468-69 (Fed. Cir. 1990); cf. Aro Mfg. Co. v. Convertible Top Replacement Co., 377 U.S. 476, 488 (1964) (stating that section 271(c) requires a showing that an alleged contributory infringer knew that acts would be infringing). The Plaintiff has not conclusively established direct infringement of each of the patents for which it alleges inducement to infringe under 35 U.S.C. §

271(b). In fact, with this opinion, the Court dismisses a number of those direct infringement claims. And, though when viewed in the light most favorable to Plaintiff, the nonmovant, the Court presumes that Plaintiff may establish direct infringement for the claims that remain viable, inducement imposes a more specific showing.

Defendant argues that the only evidence of inducement presented by Plaintiff is the report produced by its damages expert, Mr. Sims, whose calculations predict market penetration of Defendant products as contained in end-products exported by foreign companies. §271(b) Mot. at 6.<sup>4</sup> To estimate the percentage of those products that may incorporate Defendant's products, the report relies on an industry report of the total U.S. imports of cellular telephones and base stations,. Id. However, it does not point to specific Defendant customers, confirm that those customers use the accused products, or suggest that Defendant tracks such data. Id. at 7; Appendix, Ex. H. at 55. Without a showing that Defendant knowingly induced infringement, with the specific intent to encourage its customers to infringe, that Defendant's acts did induce such infringement, and that Defendant knew or should have known that actual infringement would result, inducement under §271(b) has not been adequately demonstrated. See C.R. Bard, Inc. v. Advanced Cardiovascular Systems, Inc., 911 F.2d 670 (Fed. Cir. 1990)(holding that a person induces infringement by actively and knowingly aiding and abetting another's direct infringement); Hewlett-Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1469 (Fed.

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<sup>4</sup> In its opposition, Plaintiff goes to great lengths to validate the damages calculations made by Mr. Sims. The Court makes no determination with respect to the damages questions on which Mr. Sims ultimately opines. The Defendant does not challenge his methodology for calculating damages and the question of damages is reserved for the jury. Pl's. Resp. to §271(b) Mot. at 8; §271(b) Reply at 2; Riles v. Shell Exploration and Production Co., 298 F.3d 1302, 1308 (Fed. Cir. 2002)("The assessment of damages is a question of fact, and is decided by the jury when tried to a jury.") quoting Festo, 72 F.3d at 866.

Cir.1990) (requiring proof of actual intent to cause the acts which constitute the infringement as a necessary prerequisite to finding active inducement).

Plaintiff counters that despite its repeated request for production of information regarding international sales data, Defendant has failed to produce it. Pl's. Resp. to §271(b) Mot. at 4. The theory of infringement, whether under §271(b) or §271(g), relies on the same facts. Id. at 9. 35 U.S.C. §271(g) states that:

whoever without authority imports into the United States or offers to sell, sells, or uses within the United States a product which is made by a process patented in the United States shall be liable as an infringer, if the importation, offer to sell, sale, or use of the product occurs during the term of such process patent...

35 U.S.C. §271(g). But, a reading of §271(g) reveals that Plaintiff cannot sustain its claim under this subsection either. "Infringement under § 271(g) does not consist of the making of a product by a process patented in the United States; liability arises if it is the importation, offer to sell, sale, or use of a product made by such process occurs during the term of such process patent.

Bio-Technology General Corp. v. Genentech, Inc., 80 F.3d 1553, 1560 (Fed. Cir.1996) citing 35

U.S.C.A. § 271(g). The Federal Circuit has not expanded the application of Section 271(g)

beyond methods of manufacture. See, e.g., Bio- Technology Gen. Corp. v. Genentech, Inc., 80

F.3d 1553, 1560-61 (Fed. Cir.1996) (holding that importation of hormone made by patented

recombinant DNA techniques infringes under § 271(g)); Eli Lilly & Co. v. Am. Cyanamid Co.,

82 F.3d 1568, 1571-73 (Fed. Cir.1996) (holding that importation of antibiotic does not infringe

patent claiming method of making intermediate compound where compound was "materially

changed"); Mars, Inc. v. Nippon Conlux Kabushiki-Kaisha, 855 F. Supp. 670, 672 (D.Del.1993),

aff'd, 58 F.3d 616 (Fed. Cir.1995) (holding that patent describing process by which electronic

coin changer in vending machine analyzes coins is not manufacturing process and, therefore, not covered by § 271(g)). Plaintiff has failed to establish that Defendant or its customers import, sell, or use the cellular phones and telecommunications devices in violation of § 271(g), nor has Plaintiff shown that the process employed in manufacturing those devices infringed the patents. Standard Havens Products, Inc. v. Gencor Industries, Inc., 953 F.2d 1360, 1374 (Fed. Cir.1991)(refusing to apply § 271(g) where there was no evidence in the record showing that the foreign purchaser shipped products back to the United States made abroad by the patented process). Based on the absence of evidence either of inducement as required by § 271(b) or importation under § 271(g), summary judgment is granted.

**D. Motion for Summary Judgment Regarding U.S. Patent No. 34,269**

After fabrication of a semiconductor chip, that chip is mounted on a thin, copper frame, called a “lead frame” and then encapsulated in a “package,” often made of a ceramic or plastic material, intended to protect the chip from damage and to provide a convenient way to make electrical connections to the chip’s circuitry. The ‘269 patent includes a typically square and flat package surface, called a “paddle,” which is connected to an external mounting frame by “paddle support arms,” and upon which a semiconductor chip is mounted. In the process of mounting the chip, the paddle is pressed down and deformation in the paddle support arms can occur. To minimize such deformation, the ‘269 patent claims the invention of a structure called a “deformation absorbing member” as part of the paddle support arms. The Court construed “deformation absorbing members” as “a structure located on a paddle support arm that localizes deformation during paddle downsetting and maintains desired physical characteristics.” Mem. & Order at 56.



Defendant moves for summary judgment that it does not infringe any of the asserted claims, Claims 1, 4, 6, and 9 of the '269 patent, either literally or under the doctrine of equivalents.<sup>5</sup> The '269 patent reads:

1. A semiconductor integrated circuit package comprising: a semiconductor integrated circuit chip; a lead frame, said lead frame having a paddle on which said chip is mounted and paddle support arms; and an external mounting frame having a plurality of fingers, electrical connections from said chip to said fingers, said paddle being connected to said external mounting frame by said paddle support arms CHARACTERIZED IN THAT said paddle support arms comprise a deformation absorbing member, said paddle being depressed with respect to said external mounting frame, said deformation absorbing member localizing deformation during paddle downsetting and maintaining desired physical characteristics.
4. A package as recited in claim 1 in which said deformation absorbing member comprises an annular member.
6. A semiconductor integrated circuit package comprising:  
a semiconductor integrated circuit chip;  
a paddle on which said chip is mounted;  
a plurality of paddle support arms, said paddle being connected to said paddle support arms;  
a plurality of fingers;  
electrical connections from said chip to said fingers;  
CHARACTERIZED IN THAT said paddle support arms comprise a deformation absorbing member, said paddle being depressed with respect to at least a portion of said fingers, said deformation absorbing member localizing deformation during paddle downsetting and maintaining desired physical characteristics.
9. A semiconductor integrated circuit package as recited in claim 6 in which deformation absorbing member comprises an annular member.

'269 Patent at col. 3:29 through col. 4:39. Defendant claims that because the undisputed evidence indicates that the lead frames used for packaging Defendant's semiconductor chips are clamped, the accused features do not constitute "deformation absorbing members," and the bond

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<sup>5</sup> As an initial matter, Defendant notes that it does not manufacture or fabricate the "lead frames," or perform the packaging step; rather, Defendant sends the fabricated semiconductor chips to one of its packaging contractors for packaging, including mounting the chip in a lead frame and encapsulating it in epoxy. '269 Mot. at 10; Kovats Depo at 8:1-25; Foster Dep. at 54:24-56:41; Nickelsen Dep. at 67:7-68:15.

diagrams do not represent actual lead frames used in Defendant's packaging, Plaintiff cannot sustain a claim of infringement. '269 Mot. at 13-25. Secondly, Defendant argues that the damages for infringement of the '269 patent must be limited, at a minimum, to those occurring after September of 1999 under 35 U.S.C. § 287. '269 Mot. at 25.<sup>6</sup>

In conformity with industry practice dating back to the 1980's, Defendant's processes, as explained by the packaging expert, Dr. Prince, "use a stripper plate to clamp the leads and paddle support arms of the lead frame during the downsetting process." Second Prince Exp. Rep. at 4-5. Similarly, representatives of all four packaging contractors, agree that clamping occurs during the downsetting of lead frames in all accused processes. See e.g., Foster Dep at 58:25-60:17, 60:18-61:21, 62:9-64:4, 147:23-149 (explaining that during the downsetting process, which employs general metallurgy principles, "the machine clamps immediately above the bend to control deformation of the paddle support arm," and that clamping occurs as close to the downset as possible, extending over the paddle arms); Nickelsen Dep. at 70:19-71:15, 72:1-74:17, 83:3-13

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<sup>6</sup> The Court generally makes no determination with respect to the damages questions because the question of damages is reserved for the jury. See supra n.3. Compliance with § 287(a) is a question of fact that must be pled and proven by the patentee. Maxwell, 86 F.3d at 1111 citing Motorola, Inc. v. United States, 729 F.2d 765, 770 (Fed. Cir.1984); Dunlap v. Schofield, 152 U.S. 244, 248 (1894) ("[T]he duty of alleging, and the burden of proving, either [actual notice or constructive notice] is upon the [patentee]."). Section 287(a) of the Patent Act provides that "[a patentee] is entitled to damages from the time when it either began marking its product in compliance with § 287(a)[, constructive notice,] or when it actually notified [the accused infringer] of its infringement, whichever was earlier." Id. citing American Medical Sys., Inc. v. Medical Eng'g Corp., 6 F.3d 1523, 1537 (Fed. Cir.1993), cert. denied, 511 U.S. 1070 (1994)("Once marking has begun, it must be substantially consistent and continuous in order for the party to avail itself of the constructive notice provisions of the statute.") A patentee who makes, uses, or sells its own invention is obligated to comply with the marking provisions to obtain the benefit of constructive notice. Id. Defendant argues and Plaintiff agrees that with respect to alleged infringement of the '269 patent, damages may be limited to those resulting from alleged infringement after September 1999. '269 Mot. at 27; Pl's. Resp. to '269 Mot. at 23. After a thorough review of the record, we agree.

(describing how clamping occurs at the edge of the downset area, extending to the outside of the lead frame); Ooi Dep. at 114:17-116:22 (describing the process ChipPac employs during which a tool holds the paddle support arm in place at the downset area); Karnezos Dep at 44:6-47:16, 47:17-48:3 (clamping prevents deformation from occurring anywhere other than the downset); Kovats Dep. at 90:13-91:22. Defendant further argues that the prosecution history of the ‘269 patent should preclude an interpretation that would cover the accused lead frames; where an applicant makes arguments limiting the ordinary meaning of the claim, distinguishing prior art, or disclaiming equivalents during prosecution, such limitations may preclude a finding of infringement under the doctrine of equivalents. ‘269 Mot. at 17-20 (citations omitted).<sup>7</sup>

Defendant next criticizes the tests employed by Plaintiff’s expert, Dr. Kohl, for their failure to simulate the actual accused downsetting process that occurs during the lead frame manufacturing. ‘269 Mot. at 22. Instead of conducting tests on the actual accused devices, Dr. Kohl uses Plaintiff’s devices which Defendant argues “do not remotely resemble the vast majority of accused lead frames.” *Id.* at 23. As a result, those tests only show how Plaintiff’s lead frame absorbs deformation if stressed, but does not prove that Defendant’s challenged feature actually localizes deformation during paddle downsetting. ‘269 Reply at 1, 6. Finally, Defendant argues that, because Defendant generally defers to the subcontractor’s preference in designing lead frames, the bond diagrams provided by one of its engineering managers, Mr. Kovats, are

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<sup>7</sup> The only reference Defendant makes to arguments suggesting the patentee’s surrender of clamped paddle support arms appears in a footnote where Defendant writes that, “The ‘269 patent applicants *undoubtedly did not feel* that the ‘269 patent applied to clamped paddle support arms, notwithstanding the prevalent use in the industry, as the co-inventors did not themselves use clamping in their laboratory experiments.” ‘269 Mot. at n.6 citing Moyer Dep. 34:6-41:12, 60:19-61:1 (describing the downsetting process, and noting that “you don’t want to clamp because you want the arm to be able to move.”).

insufficient support for Plaintiff's claims as they only provided the basic specifications. Id. at 24.

In response, Plaintiff argues that though at the claim construction, Defendant failed to ask the Court to construe "deformation absorbing member" based on the prosecution history, it now incorrectly argues that the patent applicants surrendered the subject matter during prosecution of the '269 patent. Pl's. Resp. to '269 Mot. at 9. Plaintiff then conducts a thorough review of the statements made to the PTO to demonstrate that those statements were not intended to unequivocally surrender all subject matter related to clamping, but rather focused on clamping that "prevents movement of the entire structure." Id. at 10-12; Lee Decl. Ex. 29 at AG 006736. Because Defendant's method of clamping used in manufacture of lead frames does not completely isolate the paddle support arms from deformation during paddle downsetting, an argument of surrender must fail. Id. at 13 citing Prince Tr. at 92:11-18 (explaining that clamping that totally isolates the upper portion of paddle support arm, partially isolates, or does not clamp at all are all equally possible).<sup>8</sup> And, finally, Plaintiff argues that Dr. Kohl's test confirm that clamping does not provide physical isolation from deformation. Id. at 17-18; Kohl Tr. at 261, Kolh Opp. Decl. at ¶¶ 38-42. On the basis of the record, a genuine issue of material fact remains that leaves open the question of whether the accused processes may directly infringe or may be sufficiently equivalent to the claims in the '269 patent. As such, summary judgment as to Claims 1, 4, 6, and 9 is denied. Warner-Jenkinson, 520 U.S. at 40.

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<sup>8</sup> Plaintiff also discredits the conclusions reached by Dr. Prince and the packaging subcontractors on which Defendant relies. The Court does not summarize those critiques here but recognizes the resulting factual questions, arising from inconsistent interpretations.

**E. Non-Infringement of U.S. Patent No. 6,323,126**

The '126 patent refers to a process for creating tungsten for metallization through which the contact openings are filled by a reaction that results from the exposure of silicon to tungsten hexafluoride ("WF<sub>6</sub>"). '126 Patent at col. 1:16-25. Defendant moves for summary judgment for non-infringement of the '126 patent Claims 1-6 and 8. Claim 1 requires in pertinent part:

1. exposing said layer of material [amorphous silicon or polycrystalline silicon] to WF<sub>6</sub>, thereby forming a tungsten plug which completely fills said opening, and forming a tungsten layer which covers said dielectric

'126 Mot. at Ex. 1. The '126 patent contains limitations that require:

forming a layer of material chosen from the group consisting of polysilicon and amorphous silicon within said opening, and overlying all of the exposed portion of said substrate and said dielectric, said layer not completely filling said opening;  
 exposing said layer of material to WF<sub>6</sub>, thereby forming a tungsten plug which completely fills said opening, and forms a tungsten layer which covers said dielectric;

'126 patent at col. 3:18-26. Defendant argues that no processes it employs infringe the '126 patent because (1) tungsten produced by the reaction of a layer of silicon with WF<sub>6</sub> does not completely fill the opening(s) in the dielectric, and (2) "no layer of silicon is deposited in the openings, overlying the entire substrate and on the dielectric." Id. at 1.

**1. Openings Completely Filled by Singular Gas Reaction**

The accused "300 Torr" tungsten deposition recipe contains a "silane soak" step that exposes the contact openings to a combination of gases at a range of pressures in order to prepare the wafer for the subsequent tungsten nucleation step and to ensure that the nucleation layer is uniform. '126 Mot at 4; Schwechel Dep at 64:2-19. The accused Nantes process recipe also employs a "silane soak" with lower pressure applied than that in the "300 Torr" process, but the two are substantially similar. Id. Defendant argues that claim language, specification, and

prosecution history of the '126 patent require that the openings be filled completely by one gas reaction of  $WF_6$  with a layer of previously deposited solid silicon. '126 Mot. at 9-13. Because the limitation language requires the exposure of  $WF_6$  to "completely fill[]" the opening, Defendant suggests that it excludes any process that fills the opening by other means. *Id.* at 9. Similarly, Defendant notes the absence of reference in the specification to exposure to a gas mixture comprised of two or more gases.<sup>9</sup> Finally, Defendant points to the prosecution history in which the applicants distinguishes the '126 patent from a "blanket layer tungsten process, which utilizes two reacting gases." '126 Mot. at Ex. 2. Instead, the applicant claims to have "discovered an effective way of making tungsten plugs...which does not require the use of the blanket tungsten process." *Id.* In contrast, in Defendant's processes, the contact hole or via is filled by tungsten produced by a reaction between  $WF_6$ , silane (" $SiH_4$ "), and/or molecular hydrogen (" $H_2$ "). '126 Mot. at 14; Schwechel Dep. at 64:12-19.<sup>10</sup>

In response, Plaintiff points directly to the language of the limitation, arguing that where it reads "exposing layer of material to  $WF_6$ , thereby forming a tungsten plug which completely fills said opening...", Defendant inserts "to *only*  $WF_6$ ," improperly limiting the '126 patent in a way unsupported by the claim, specification, or prosecution history. Pl.'s Resp. at 17. Such a reading would render the '126 patent inoperable, argues Plaintiff. *Id.* at 18 citing Wang Labs.

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<sup>9</sup> In support of this proposition, Defendant refers to the deposition testimony of Mr. Chittipeddi, co-inventor of the '126 patent, as confirmation that the specification does not consider exposure to other gases. Mr. Chittipeddi points to line 27 which reads "expose to a gas *such as* tungsten hexafluoride" but indicates that the specification does not require exclusivity. '126 Mot. at 10; Chittipeddi Dep. at 45:10-46:1 (emphasis added).

<sup>10</sup> In his report, Plaintiff's expert, Mr. Reif notes that "the silicone layer is subsequently reacted with the  $WF_6$  in a nucleation step *before* the tungsten chemical vapor deposition step *completely fills* the opening and covers the dielectric with tungsten." Reif Inf. Expert Rep. at 21 (emphasis added).

Inc. v. America Online, Inc., 197 F.3d 1377, 1383 (Fed. Cir. 1999)(claims construed narrowly to preserve validity). Plaintiff next points to the specification to argue that both the selective and blanket tungsten processes were recognized through the prior art and that ‘126 only requires the use of WF<sub>6</sub>, leaving the choice of reducing gas to those skilled in the art. Id. at 20. The ‘126 patent, written in the “comprising” form allows for additional steps and/or reactants. Id. Finally, Plaintiff points to the prosecution history to emphasize that at no time did the inventors describe the system as a single gas process, but rather as a hybrid or “quasi-selective” process. Id. But, accepting either party’s argument would require the Court to interpret the factual record to construe claim terms. Summary judgment is unavailable where a genuine issue of material fact exists that would require expert testimony to explain the nature of the invention and/or the accused process in their comparison. Amhil, 81 F.3d at 1557-1558.<sup>11</sup>

## **2. Layer of Solid Silicon Deposited on Wafer**

Defendant further claims non-infringement of the ‘126 patent, arguing that the accused tungsten deposition processes do not contain a step in which a layer of solid silicon is deposited overlying all of the exposed portions of the substrate and dielectric. In so doing, Defendant discredits the assertion made by Mr. Reif that one skilled in the art of semiconductor processing would recognize that when Defendant exposes the wafer to SiH<sub>4</sub> gas, under certain time, pressure, and temperature conditions, it decomposes to form a layer of silicon over the exposed wafer surface. In reaching his conclusion, Mr. Reif cites to the deposition testimony of Ms.

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<sup>11</sup> In the Memorandum and Order, the Court did not construe any of the terms in the ‘126 patent because though the parties initially disputed some terms therein, neither at the Markman hearing nor in its post-hearing brief and proposed order, did Defendant offer proposed constructions or arguments regarding those terms. The Court concluded that no dispute existed over the proper construction deeming construction unnecessary. Mem. & Order at 47.

Schwechel, Defendant's tungsten deposition engineer, based on information provided by Applied Materials, the tungsten deposition chamber vendor. Schwechel Decl. ¶¶ 2-3; Schwechel Depo at 165:1-18. To suggest that the basis for Mr. Reif's opinions lack evidentiary support from the record, Defendant points to Novartis Corp. v. Ben Venue Labs, 271 F.3d 1043 (Fed. Cir. 2001). But, in Novartis, the court required that the factual predicate of an expert's opinion must find *some* support in the record beyond mere "theoretical speculations." Id. at 1052 (emphasis added). Without an adequate basis in the record, there can be no genuine issue of fact. Id. Yet, Plaintiff relies on Defendant's own witness testimony during which Ms. Schwechel states that the silane soak step introduces "silane onto the hot wafer to form a monolayer of silicone on the wafer." P's Opp. to '126 Mot. at 10 citing Lee Decl. Ex. 36; Schwechel Tr. at 63:16-20. That Ms. Schwechel relied on Applied Materials, the developer of the "300 Torr" tungsten deposition process, does not in itself create an absence of a record.<sup>12</sup> Defendant argues that because Ms. Schwechel performed no independent experiments, the Court should look instead to the tests conducted by Defendant's expert, Dr. Thomas, establishing that the "silane soak" does not coat the entire substrate with a layer of silicon. '126 Mot. at 15. These experiments, Defendant suggests, conclusively establish that Defendant's processes "do not result in any *meaningful*, and certainly not in any *contiguous* layer of silicon, overlying the entire substrate." '126 Mot. at 18 (emphasis added). When viewed in the light most favorable to the nonmovant, drawing all justifiable inferences in the nonmovant's favor, a meaningful genuine issue whether the accused

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<sup>12</sup> Plaintiff also offers two publications by Applied Materials to corroborate Ms. Schwechel's testimony: U.S. Patent No. 6,303,480 (the "Desai '480 patent) and S. Herner et al., "Homogeneous Tungsten Chemical Vapor Deposition On Silane Pretreated Titanium Nitride," *Electrochemical and Solid State Letters*, 2 (8) 398-400 (1999).



processes are encompassed by the '126 patent remains.

**F. Non-Infringement of Claims 1 and 4 of U.S. Patent No. 5,227,335**

As the Court has previously summarized, tungsten metal may be used as the conductive material to fill the openings formed in a dielectric layer. Though it does not generally adhere well to the dielectric material, tungsten provides an advantage over other metals in that it can be used in narrower openings, allowing fabrication of smaller chips. The '335 patent is directed to a process intended to rectify this problem by depositing a "glue layer," containing an electrically conducting material between the dielectric and the tungsten which allows the tungsten to adhere to the dielectric. After the openings have been created, a glue layer is deposited over the entire surface of the wafer and then a tungsten layer is deposited over the glue layer. A process follows to remove the portions of the tungsten and glue layers not within an opening, leaving a relatively flat surface of dielectric with openings now filled with both tungsten and a glue layer between the tungsten and the dielectric. Claims 1 through 8, and Claim 10 of the '335 patent are at issue in this lawsuit. Mem. & Order. at 10-11.

**1. Application of Layer of Titanium and Titanium Nitride Deposited into Contact Holes and Vias**

The Defendant moves for summary judgment with respect to Claim 1 of the '335 patent, which reads, in pertinent part:

1. A method of fabricating an integrated circuit comprising the steps of: patterning a dielectric layer to form holes which expose the underlying material, said exposed underlying material comprises an electrically conducting material; depositing a glue layer covering said dielectric and said exposed underlying material; depositing a tungsten layer by chemical vapor deposition, said tungsten layer covering said glue layer on said dielectric and said exposed material; CHARACTERIZED IN THAT said glue layer comprises at least one member selected from the group consisting of conducting nitrides.

‘335 Mot. at 7; Ex. 1 (‘335 Patent ) col. 5:22 – 6:6. Defendant argues that unlike in Plaintiff’s process, they use two layers, titanium and titanium nitrate, deposited into different chambers with different gases. ‘335 Mot. at 16. No process Plaintiff employs uses titanium and titanium nitride in the contact holes and as a result of Defendant’s dual-layer deposition process, the top layer of tungsten is not planar with the surface of the dialectic as required by the “glue layer” requirement of the ‘335 patent. Id. at 9-11. Plaintiff argues that ample evidence suggests that the titanium and titanium nitrate deposited in the contact holes constitute a “glue layer” and that a glue layer need not be of uniform composition according to ordinary usage by persons skilled in the art. Pl’s. Resp. to ‘335 Mot. at 11-14; Reif Opp. Decl. at ¶ 14.<sup>13</sup> Plaintiff further argues that nothing in the intrinsic evidence limits the scope of the term “glue layer” beyond its ordinary meaning to persons skilled in the art. Id.; Reif Opp. Decl. ¶¶ 7-9; Thomas Tr. at 463:14-25. In the claim construction of the ‘335 patent term “glue layer,” the Court found that the specification which reads “[t]he glue layer comprises *at least one material* selected from the group consisting of Al and conducting nitrides such as TiN. . .clearly implies that the glue layer may consist of multiple materials.” Construction Order at 16; ‘335 Patent at col. 3:67 – col. 4:1 (emphasis added). So, despite the fact that Defendant’s process employs two materials, when combined, those may still constitute a “glue layer” under the Court’s construction.

However, this does not end the inquiry. The Court also determined that the specification

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<sup>13</sup> Defendant points to Mr. Reif’s deposition testimony during which he concedes that: “Titanium nitride has a precise composition. If we’re defining layers by their composition, these are two distinguishable films. If we’re defining them by their function, these two are a glue layer.” Reif Dep. at 151:10-15. However, this does not sufficiently concede Plaintiff’s consistent argument with respect to “glue layer.” See Reif Opp. Decl. ¶¶ 7-13; Reif Tr. at 147:23-148:1; Lee Decl. Ex. 32, 37, Thomas Tr. at 465:23-466:9; Whiteman Tr. at 482:17-23.

that states “the glue layer film may be deposited, through openings in the dielectric, *directly on* the silicon or on a conducting material, such as a silicide, overlying the silicon’... indicates that the patentee contemplated that the glue layer would be in direct contact with both the dielectric and the exposed underlying material.” Mem. & Order at 16; ‘335 Patent at col. 3:7-11 (emphasis added). The Court interpreted the ‘335 patent to require that the layer be deposited prior to the tungsten and “have good adhesion *both* to the underlying dielectric layer and to the tungsten;” based largely on the prosecution history, the Court construed the term “covering” as “lying over and *directly* contacting.” *Id.* at 17-21 (emphasis added). As Defendant points out, the titanium nitrate layer employed by Defendant does not directly contact the dielectric. ‘335 Mot. at 11,17; Schwechel Decl., ¶ 2-3.<sup>14</sup> Because Plaintiff cannot demonstrate that Defendant’s processes not only employ the use of a “glue layer” but also that said layer *directly* contacts the underlying dielectric layer, the accused processes do not contain each element of the asserted claim and do not literally infringe the ‘335 patent. S. Bravo Systems, 96 F.3d at 1376.

In the alternative, Defendant contends that the accused elements do not infringe under the doctrine of equivalents because the narrowing amendment in the prosecution history required the glue layer to cover the entire dielectric and “whatever material was in the bottom of the holes.” ‘335 Mot. at 22; Ex. 2 at AG006868-6875 (Nov. 23, 1987 Response to Office Action). Plaintiff suggests that the prosecution history to which Defendant points does not bar analysis

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<sup>14</sup> Plaintiff points to Schwechel’s deposition testimony in which she confirmed that with *neither* the titanium nor titanium nitride prior to the deposition of tungsten, the film would peel off to suggest that the tungsten adheres well to both the titanium and titanium nitride. Pl.’s Resp. to ‘335 Mot. at 16. Again, the Court does not read such a concession in Schwechel’s testimony. That the presence of *neither* material would eliminate adherence does not lead to the automatic conclusion that the presence of *both* is required for such adherence.

under the “all elements rule” of the doctrine of equivalents such that the issue should proceed to the jury. Pl.’s. Opp. to ‘335 Mot. at 18-19. Plaintiff further argues that the “function-way-result test” applies to determine whether the alleged process performs substantially the same function.

Lawman Armor Corp. v. Winner Int’l, Inc., 2002 WL 123342 at 815 (E.D.Pa. Jan. 28, 2002).

However, as the Court previously noted, “the patent applicants relinquished a construction of the term ‘covering’ that would not require direct contact between the glue layer and both the dielectric and the exposed underlying material.” Mem. & Order at 20 citing AG 006874.

Despite Plaintiff’s argument that the amendment bore no correlation to patentability, as discussed above, the Court may still require application of the estoppel doctrine. The patentee surrendered the construction of “covering,” and confirmed, by Mr. Reif’s testimony, that the possibility of introducing sublayers of different materials was foreseeable in the industry. Pl.’s Resp. to ‘335 Mot. at 9; Ref Opp. Decl. at ¶¶ 10-13. Plaintiff’s argument that the amendments had no more than a tangential relation to the definition of “glue layer,” even if true, does not eliminate the significant relationship it had to the adhesion element of the claim. Id. at 19. Finally, it seems possible, at a minimum, that the patentee could have reasonably described a process that did not require *direct* contact between both the dielectric and the exposed underlying material.

Mycogen, 2004 WL 363344, \*3 (Fed. Cir. 2004). As such, the accused elements do not seem sufficiently equivalent to each claimed element of the ‘335 patent such that summary judgment as to Claim 1 is granted.

## **2. Plasma Etch Process**

The Defendant also moves for summary judgment with respect to Claim 4 of the ‘335 patent, which reads, in pertinent part:

4. A method as recited in claim 1 further comprising etching said tungsten and said glue layer to form a planar surface of said dielectric and said tungsten in said hole, said tungsten being etched before said glue layer.

Ex. 1 ('335 Patent ) col. 6:11-14. Defendant argues that in order to maintain its claim, Plaintiff must demonstrate that the accused tungsten processes contain a step for removing both the tungsten and all material deposited between the dielectric and the tungsten, such that the top surface of the tungsten forms a planar surface with the dielectric. '335 Mot. at 27. Further, without citation to the record, Defendant concludes that the accused process does not produce planar layers with the dielectric as required by Claim 4 and do not infringe literally or under the doctrine of equivalents because the Defendant's plasma etching leaves the intervening layers of titanium and titanium nitride over the dielectric. Id. In contrast, Plaintiff points to the Court's construction of Claim 4 to argue that the claim merely requires some removal of tungsten and glue layer by chemical or physical means such that the surface of tungsten and dielectric is "substantially two dimensional or flat." Pl's. Resp. at 22 citing Holschwander '335 patent. Defendant's own expert concedes that the oxide is essentially planar with the top of the plug." Id. at 23 citing Lee Decl, Thomas Tr. at 340:22-341:9. Though the Court construes the term "etching" as "the process for removing material in a specified area through a wet or dry chemical reaction, or by physical removal, such as by sputter etch," such a construction does not specifically exclude Defendant's process as described from the parameters of the '335 patent. Mem. & Order at 23.<sup>15</sup> Plaintiff suggests that a genuine issue of material fact exists as to whether Defendant's plasma etch processes infringe Claim 4. Id. citing Anderson, 477 U.S. at 248

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<sup>15</sup>The final product yielded by these processes, a semiconductor chip, measures no more than a few millimeters in thickness; at such infinitesimally small dimensions, the Court is unwilling to definitively conclude the factual question of whether layers therein are planar.

(1986). We agree. Because the accused processes may directly infringe or may be sufficiently equivalent to each claimed element of the '335 patent, summary judgment as to Claim 4 is denied. Warner-Jenkinson, 520 U.S. at 40.

#### **IV. CONCLUSION**

For all these reasons, the Defendant's Motion for Summary Judgment of Non-Infringement of Claims 1 Through 5 of U.S. Patent No. 5,102,827, (Doc. No. 95) is GRANTED, the Motion for Summary Judgment of Non-Infringement of Claims 1-3 and 5 of U.S. Patent No. 5,149,672 (Doc. No. 96) is GRANTED, the Motion for Summary Judgment of Non-Infringement Pursuant to 35 U.S.C. § 271 (b) (Doc. No. 97) is GRANTED, the Motion for Summary Judgment Regarding U.S. Patent No. 34,269 (Doc. No. 98) is DENIED, the Motion for Summary Judgment for Non-Infringement of U.S. Patent No. 6,323,126 (Doc. No. 99; Doc. No. 110) is DENIED, the Motion for Summary Judgment for Non-Infringement of Claims 1 and 4 of U.S. Patent No. 5,227,335 (Doc. No. 100) is GRANTED as to Claim 1 and DENIED as to Claim 4. An appropriate order follows.

